

CLAIMS

1. A manufacturing method of a semiconductor device, comprising the steps of:
selectively injecting impurities into a semiconductor substrate to form an
5 impurity region;

processing a laser beam having a fundamental wave into a long beam on a
surface of the impurity region; and

moving the surface of the impurity region relatively to the long beam to scan
the laser beam to activate the impurity region.

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2. A manufacturing method of a semiconductor device, comprising the steps of:
forming a gate insulating film over a semiconductor layer of an SOI substrate;
forming a gate electrode over the gate insulating film;

selectively injecting impurities into the semiconductor layer of the SOI
15 substrate to form an impurity region;

processing a laser beam having a fundamental wave into a long beam on a
surface of the impurity region; and

moving the surface of the impurity region relatively to the long beam to scan
the laser beam to activate the impurity region.

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3. The manufacturing method of a semiconductor device according to claim 1
or 2, wherein the impurity region is source and drain regions of a field effect transistor.

4. The manufacturing method of a semiconductor device according to claim 1
25 or 2, wherein the impurity region is an extension region of a field effect transistor.

5. The manufacturing method of a semiconductor device according to any one
of claims 1 to 4, wherein the laser beam having a fundamental wave is oscillated with a
pulse width of 1 femtosecond or more and 10 picoseconds or less.

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6. The manufacturing method of a semiconductor device according to any one of claims 1 to 5, wherein the laser beam having a fundamental wave is emitted from one kind of lasers in which one or more of Nd, Yb, Cr, Ti, Ho and Er, is/are added as a dopant into a crystal of Sapphire, YAG, ceramics YAG, ceramics Y_2O_3 , KGW, KYW, 5 Mg_2SiO_4 , YLF, YVO_4 , or $GdVO_4$.

7. The manufacturing method of a semiconductor device according to any one of claims 1 to 6, wherein the laser beam is pulsed laser light with a repetition rate of 10MHz or more.

10 8. A semiconductor device having an integrated circuit including a field effect transistor, comprising:

a gate insulating film formed over a semiconductor layer;

a gate electrode provided over the gate insulating film;

15 a channel forming region formed in the semiconductor layer under the gate electrode through the gate insulating film;

an extension region into which an n-type or p-type impurity element is added, and which is located on opposite sides of the channel forming region; and

20 a source region and a drain region which are in contact with the extension region,

wherein the extension region is has a junction depth shallower than the source region and the drain region; and

wherein a length of the channel forming region is 5 nm or more and 80 nm or less.

25 9. The semiconductor device according to claim 8, the length of the channel forming region is equal to a width of the gate electrode.

30 10. The semiconductor device according to claim 8 or 9, wherein the integrated circuit includes at least one of a controller, a CPU and a memory.